Dr. Otto regards the sense of smell as one of the very best means of detecting this acid. Orfida, Lounsdale and Christison coincide with him, and our investigation points in the same direction. Profs. Wormley and Taylor, however, consider a chemical test more reliable and delicate.

It will be noticed that the sense of smell seems to be more delicate in males than in females. This result coincides with that previously obtained by Profs. Bailey and Nichols, while the females possessed a more delicate sense of taste.

We are able to detect smaller quantities of substances with which we are perfectly familiar, as oil of wintergreen. Without doubt education has much to do with the delicacy of this special sense, for in addition to the fact that persons who have occasion to use the sense are more skillful, we have noticed that some who at first cannot tell Prussic acid from ammonia soon learn to distinguish readily between them.

IS THE RAINFALL OF KANSAS INCREASING?

BY PROF. F. H. SNOW, OF THE UNIVERSITY OF KANSAS.

In the present paper attention is called to the fact of an increase of rainfall rather than to the various theories which have been advanced to explain such increase, or to show that there ought to be an increase.

Geologists, physicists and astronomers are harmonious in accepting it as an established fact that the earth, in common with all other worlds in the universe, is slowly passing through a series of changes from an original nebular mass of intensely high temperature to an entirely solid mass of very low temperature. The sun and the larger planets of our system illustrate the early stages in this series of changes. The earth is in an intermediate condition between the two extremes, and the earth's moon represents the extreme of entire solidity, in which the waters and the atmosphere which once covered and surrounded its surface have been absorbed within its mass, and a very low temperature continually and everywhere prevails. There can be no doubt that the earth is very gradually approaching the moon's condition, and that sometime in the far distant future, how many millions of years hence no man can determine, its atmosphere and surface waters will entirely disappear and a low temperature prevail, even in its tropical regions, far exceeding the cold of the coldest Arctic winters in the present age. There can be no doubt, therefore, that, considered with reference to long periods of time, the rainfall of the earth is diminishing. If prehistoric man, 10,000 years ago, had kept scientific records of the rainfall of his time, and it were possible to compare these records with those of the present day, it would be found that a considerable reduction of the average annual precipitation has been made in the period named. Even a thousand years might show a perceptible decrease. But in so short a period as the lifetime of a single generation of men, or even in an entire century, the average annual rainfall of the entire globe has probably been reduced to so slight an extent as to be expressed by a very few hundredths of an inch.

Yet, although the entire movement is in the direction of a reduction of the rainfall, there are without doubt local oscillations in consequence of man's influence upon nature, which in some cases result in a more rapid decrease than would otherwise be accomplished by the unaided forces of nature, and in other cases within limited areas secure an actual increase in the rainfall. I believe the State of Kansas furnishes an apt illustration of a change of the latter sort. Here the circumstances have been extremely favorable to such a change. Thirty years ago the Territory of Kansas was not occupied by the white man, and if we except a few acres cultivated by the Delaware Indians, no portion of her soil had been turned up by the plow. Her entire area was included

within the vast and almost unknown region of the "Treeless Plains" and the "Great American Desert." During that brief intervening period, more than 1,000,000 people, chiefly of the agricultural class, have taken possession of her domain, and have already brought her to the very front rank of the States of the Union in the extent and value of her agricultural products. History affords no other instance of the permanent occupation of so extensive an area previously unoccupied by man, by so large an agricultural population in so short a space of time. Here certainly, if human agency could anywhere affect climate, would such an effect be produced. Here, assuredly, if settlement ever increases rainfall, will such increase be most marked and most unmistakable. That such increase has actually taken place, I believe to be established beyond a doubt. It is a circumstance peculiarly favorable to the determination of the point in question, that although the general settlement of Kansas by cultivators of the soil is of such recent date, reliable observations upon the rainfall had been made at the military posts upon her eastern borders for a sufficient period to make possible a satisfactory comparison between the rainfall before settlement and after settlement. The records at Fort Leavenworth cover the longest period, and enable us to compare the nineteen years immediately preceding the occupation of Kansas by white settlers with the nineteen years immediately following such occupation. During the first period the average rainfall was 30.96 inches; during the second period it was 36.21 inches, giving an average increase of 5.21 inches per annum. Here we have an increase of nearly 20 per cent. in the rainfall, under such conditions as to necessitate the inference that such increase is chiefly, if not entirely, produced by causes connected with the introduction upon a large scale of an agricultural population into a previously uncultivated territory. The Fort Leavenworth records cover so long a period of time (nearly forty years), that the increased average of the second half of the period cannot be attributed to a mere "accidental variation." In the issue of *Science* for April 18, 1884, it is stated that "the supposed increased rainfall in the dry region beyond the Mississippi is not borne out by the returns of the Signal Service." But the records of the Signal Service, upon which this statement was based, include a period of only twelve years of observation, from 1871 to 1882, which is undoubtedly too short a period for either establishing or disproving the fact of a "secular" variation. We have also called attention to the fact that causes which have a tendency to secure an increased rainfall, have here been put into operation upon a grander scale than in any other portion of the dry region west of the Mississippi.

But the fact of an increased Kansas rainfall does not rest entirely upon the Fort Leavenworth observations. There are other stations in Kansas whose records cover a much longer period than that of the longest established regular station of the Signal Service. There are the twenty years' records of the United States military post at Fort Riley, the twenty-four years' records of the State Agricultural College at Manhattan, and the seventeen years' records of the State University at Lawrence. If these several periods of observation be divided into two equal parts, in each case it is found that the average rainfall of the second half is notably greater than that of the first half. At Fort Riley the increase amounts to 3.05 inches per annum, at Manhattan to 5.61 inches per annum, and at Lawrence to 3.06 inches. Expressed in per cent., the rainfall of these three stations has increased in the second half of each period of observation, at Fort Riley, 13 per cent.; at Manhattan, 20 per cent.; and at Lawrence, over 9 per cent. If this increased rainfall could be shown by the records of a single station only, or if the several stations with sufficiently long periods of observation exhibited discordant results, some indicating a decrease while others indicated an increase, or if even a single station indicated a diminished rainfall, the fact of a general increase would lack satisfactory demonstration. But the entire agreement of the four stations, whose records have value in a discussion of this question, seems to establish beyond doubt the fact of an increased rainfall in the eastern half of Kansas.

There can be no reasonable doubt that the general settlement of the western portion of Kansas would have a similar effect upon its rainfall, but it is not reasonable to expect that western Kansas will ever boast of a rainfall equal to that of eastern Kansas. So long as the eastern half of the State remains to the east of the meridian forming the western boundary of the Gulf of Mexico, the south winds will cause it to receive much larger supplies of vapor, for condensation into rain, than will be received by the western half of the State, which lies beyond the immediate track of the vapor-laden winds. It must be remembered that climatic changes are exceedingly gradual, and a rain deficiency or excess for a single year, or for two or three years in succession, must not be considered as invalidating the law of general averages. Neither should the fact that the rainfall upon the whole is increasing, induce settlers to break lands in the western third of Kansas with the expectation of successfully raising the same crops as in eastern Kansas. Such settlers will surely be disappointed. It is even doubtful if paying crops of any kind can ever be continuously produced in that region. With an average before settlement of about 15 inches per annum, the same percentage of increase as has been made in eastern Kansas in thirty years would give less than 18 inches per annum — a quantity entirely inadequate to maintain successful agriculture.

OBSERVATIONS OF NOVEMBER METEORS.

BY R. H. SHORT.

On the 15th of this month, at 2 o'clock P. M., I was examining the sun's disk with a glass giving a power of about 45 or 50 and embracing a field of view of three degrees, to locate the relative position of the sun-spots then visible. After looking at the sun for some five or six minutes, I saw a bright point of light, leaving no train that I could see, cross the middle of the field. The sun was directly in its path; nevertheless it was visible both while entering and leaving the field. The time it occupied in crossing the field was a small fraction of a second.

At the time I did not think much about it; I did not think a meteor could be seen at all near the sun, much less to appear to cross its disk. About five minutes later, another point crossed in almost exactly the same place. The apparent brightness and rate of motion were also the same. I then left the telescope and looked all around the building, to see if there was anything that could produce such an effect by coming between the glass and the sun. I was hardly willing to believe that these two objects were meteors, yet was not able to account for the phenomena in any other way.

Being still undecided, I concluded to watch the sun for a while to see another if I could. I had been looking for at least ten minutes, when a meteor, fire-ball, or something of the kind, crossed the field one-half of a degree from the sun. Its motion was slow, compared with the first, but the direction was the same in all three cases, namely, from southeast to northwest. This last was more distinct than the others, perhaps because of its distance from the sun's disk. Its apparent diameter was about that of Venus. It crossed the field (three deg.) in not less than one-fifth of a second. Its brightness was about one-half that of the sun, and color a shade of yellow. It left a train visible after the meteor had left the field. A few minutes after, clouds obscured the sun and also the western sky. It remained cloudy until about 5 o'clock. From 5 o'clock until sunset, nothing comparable to meteors was seen.

Between 8 and 9 o'clock P. M. of the same day, I saw three bright meteors follow, as nearly as I could judge, the same course as those that were seen in daylight. The radiating point of these last three was from a point in the southern part of Andromeda.

The following notices of extraordinary meteors are from "Kirkwood's Meteoric Astronomy":